Alternative Practices for Aphid and Honeydew Management on Landscape Trees

Year–End Report

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Introduction

Honeydew produced by aphids, and the sooty mould which develops on it are nuisances on landscape trees, destroying the aesthetics of the trees and dripping on the surrounding areas (Zuparko and Dahlsten 1995). This is true of many species of landscape trees and their attendant aphid pests. The linden aphid, *Eucallipterus tiliae*, has also been shown to cause early leaf senescence, less root growth, and a decrease in overall plant weight in linden trees (Dixon 1970). Excess sugars are excreted as honeydew (Dixon and Barlow 1979). In Moscow, Idaho and on the University of Idaho campus are many littleleaf linden, *Tilia cordata*. Often these are in high pedestrian or vehicle traffic areas, where honeydew becomes even more of a problem. Pest management in these areas in addition to being high priority, must be environmentally sensitive, due to proximity of human activities. We decided to explore Integrated Pest Management strategies to determine what techniques might bring the populations below the nuisance threshold.

While researching IPM techniques, and *E.tiliae* in particular we found that aphid populations are particularly difficult to control for several reasons. When there are fewer aphids in the population the aphids become more fecund, larger, and more robust (Dixon 1971b). More adults develop wings when overcrowded, and aphids are regulated by interaction between predation and aphid flight (Dixon and Barlow 1979).. Van Emden and Wratten (1990) point out that strong increases in aphid populations are followed by an increase in natural enemies, with the enemies lagging behind. They state that "Timely control may be obtained with early inundative releases.", but that quantitative information on the role of predators in population control is limited. They add that there is need for quantified pest kill rates of aphids by natural enemies in the field. There are few scientific reports of successes by natural enemies in controlling aphid populations

Methods

We concurrently began an aphid sampling regime, with a treatment program in spring of 2002. From May through August we sampled 5 leaf samples from the upper, middle and lower canopy, from each of the four directions North, East, South, and West, for a total of 12 samples from each of 33 *T. cordata* on the UI campus. The samples were taken from the most distal portion of the branch. Samples were taken approximately every 2-3 weeks. We divided the trees into three groups of 8 and 1 group of 9. Because ants can interfere with natural enemies of aphids (Dutcher et al 1998)(Dahlsten et al 1999) we decided to place trunk bands with a sticky barrier on one group of trees. A second treatment which we considered to be the industry standard was a soil drench with Merit systemic insecticide. The third group was sprayed with a relatively benign horticultural oil when leaf buds were just opening. The fourth group consisted of a

control group. Samples were monitored for small nymphs, adults, and winged adults of aphids as well as predators and parasitized aphids or "mummies".

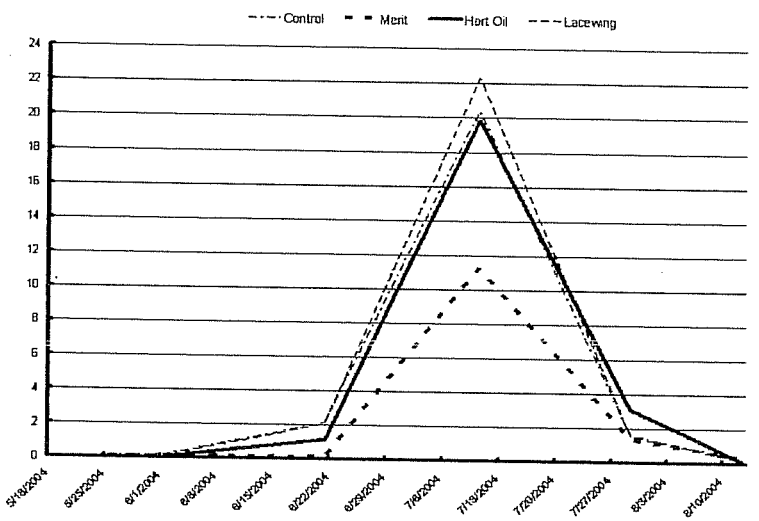
Results of data collected in 2002 indicated that the ant band treatment had little or no effect on aphid populations. Indeed few ants were observed on any of the trees except early in the season, before the aphids had really started to hatch out. In 2003 we decided to replace the ant band treatment with an inundative release of lacewings, *Crysoperla rufilabris*. We located a source of lacewings that is using a new technique for delivering pregnant lacewings, that should be ready to lay eggs upon release. Our intent was to make an early release which would enable us to monitor the effects of the lacewings on the emerging aphid population, as well as their migration after they move into other trees. We also hung aphid attracting food strips in trees where the aphids were released, to see if aphids would remain in those trees. The horticultural oil likewise had little or no effect in 2002. In 2003 we sprayed the horticultural oil later in the season to try to catch the emerging aphids for greater effect. Information obtained by our initial studies enabled us to streamline our sampling techniques. In 2003, two samples were taken from each quadrant, one from the upper crown and one from the lower crown. According to the insect seller, the food strips are ineffective when abundant honeydew is available, and honeydew was already beginning to accumulate. In 2004 we eliminated the horticultural oil spraying, because it was found to be ineffective, at least as long as there were aphid populations in adjoining trees to repopulate the sprayed trees, since there is no residual effect. We applied our lacewings earlier this spring when aphid populations were still relatively low and monitored our trees more closely in the early cooler part of the season.

Results and Discussion

Aphid Populations 2002-2004

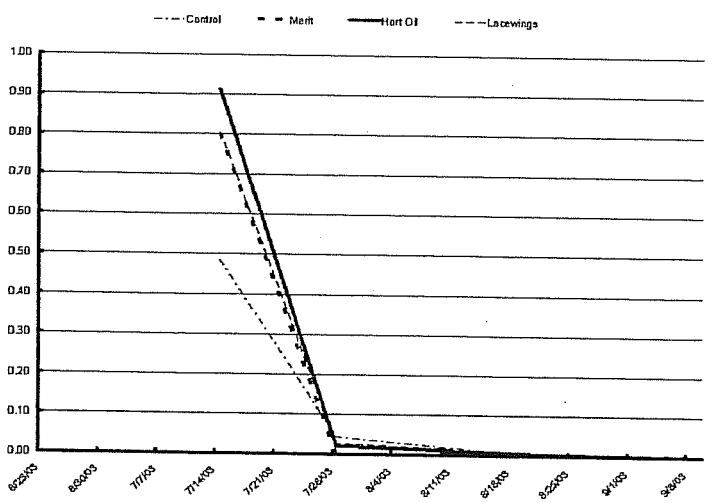
Aphid populations followed similar trends in 2002, 2003, and 2004 where a few aphids were identified and then within a period of two weeks populations increased rapidly to outbreak proportions. Rapid increases in aphids are common due to their ability to reproduce asexually. Due to the rapid increase any successful scouting efforts need to be initiated early in the season and followed up on a daily basis when the first aphids are encountered. Scheduled weekly monitoring was not effective due to the rapidity of population growth. It also appears that after population peaks in late July, the populations begin to decrease until they disappear in late August and early September. Numbers of predators and parasitoids did not increase during this time period of aphid decline, thus suggesting that some other factor is responsible for the decrease in aphid numbers.

Number of total aphids counted in each treatment during 2004

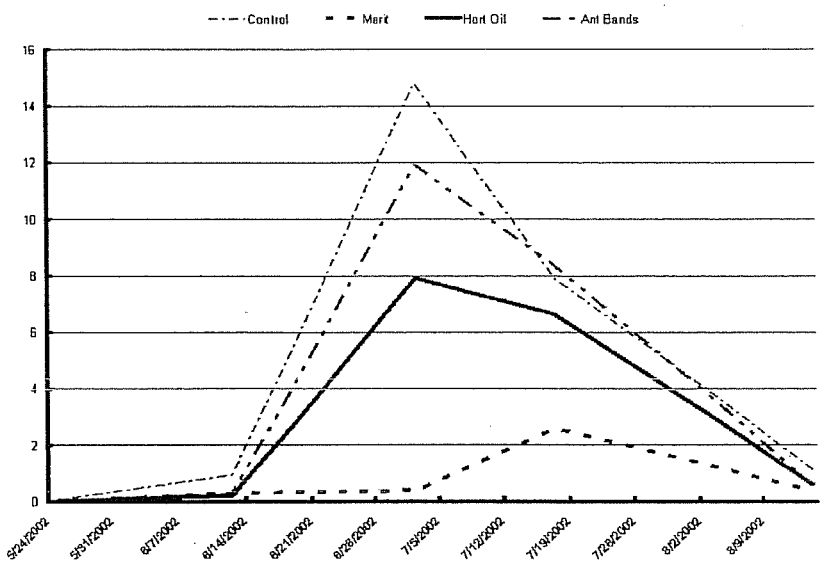


Potential for Inundative Lacewing Control of Aphids

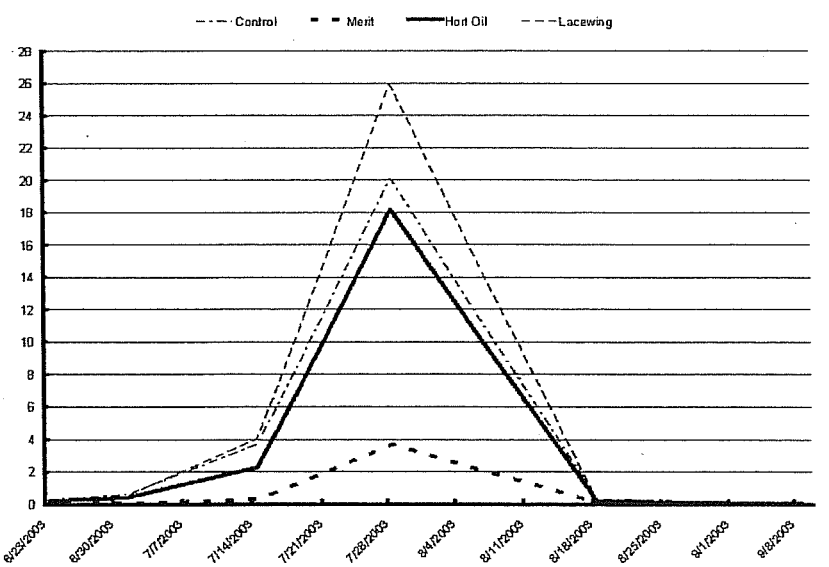
Lacewing larvae were counted after application of adult lacewings and food strips on June 26 2003 and May 22, 2004. Food strips were placed in trees where adult lacewings were released to provide a nectar source. Lacewing larvae were then counted throughout the remainder of the growing season. Data presented in this text is the number of larval lacewings counted per leaf in each treatment in 2003 and 2004.

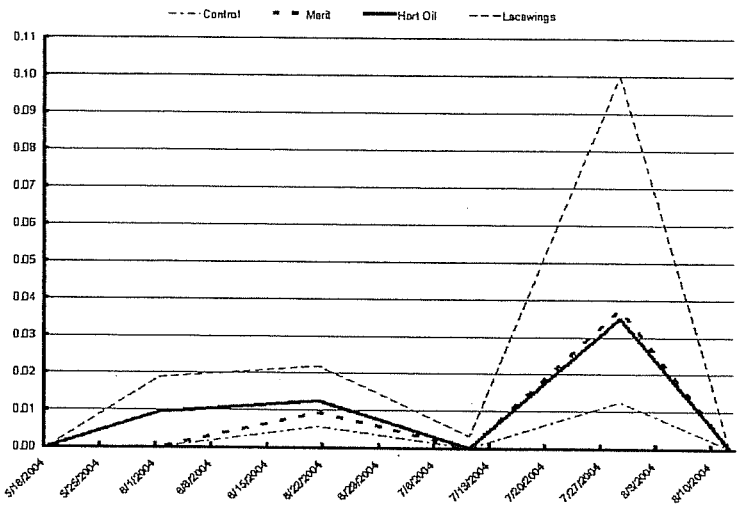


Number of total aphids counted in each treatment during 2002



Number of total aphids counted in each treatment during 2003





Lacewing larval counts were high in the first count after application in 2003, but decreased dramatically thereafter following a pattern similar to that of the decline in aphid populations. In 2004 the counts increased slightly when aphid populations also peaked, but there was no evidence to support that either of the inundative releases had any impact on the aphids. The population of lacewing larvae remained too low throughout all years of the study to provide any efficient form of aphid management. The lacewing supplier contends that several applications of lacewings may be necessary to provide control. Observations from our study indicate that the number of lacewings needed to make an impact in the rapidly developing aphid populations would be cost prohibitive.

Efficacy of Insecticides for Management of Linden Aphids

Treatment effects while apparent in yearly data, were not statistically different from the control trees due to large variations of aphid populations between trees in all the treatments in 2002 ($F=0.97$; $p=0.43$) and in 2003 ($F=1.03$; $p=0.39$). While the systemic insecticide Merit (imidacloprid) treatments did appear to reduce numbers of aphids on the trees in all three years, statistical issues with normality need to be further addressed to ascertain the level and significance of the differences. It was however, apparently obvious that neither the ant bands, lacewings, or applications of horticultural oil had any influence on reducing the aphid populations on the trees in the study.

Conclusion

We are still analyzing the data collected from all three years to develop a degree day prediction model for linden aphid development to assist with scouting and timing insecticidal treatments. Results from this analysis and refined treatment data will be made available in manuscript form for use by the IDA Nursery Advisory Committee and INLA upon completion.